

CALIFORNIA STATE DEPARTMENT OF PUBLIC HEALTH

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Weekly Bulletin



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EDITOR

Why Epidemics

(Continued from last issue)

The rapid spread of a communicable disease in a new environment appears as the natural consequence of the uniformity of the hosts. The continuous and rapid exchange which takes place is not a respector of races; lues, leprosy and smallpox have been passed from the colored race to the white and vice versa. This susceptibility, which is independent of the specific disposition, deserves a critical analysis and an explanation.

The doctrine of living causes of disease—the contagium animatum and the pathologia animata—visualizes an infection as a struggle between parasite and host. Observations taught the simple fact that the host may succumb to the onslaught of the disease agent while at the same time the parasite may be destroyed in the tissues of the host. Doubtless a very fruitful theory since it stimulated and created in the field of immunology a study of the mechanism which the infected body provides and mobilizes to defend itself against the invaders. However, the apparently logical supposition that parasites are antagonists is a fundamental error. In his brilliant treatise on "animal parasites and their messmates" van Beneden wrote in 1876:

"The parasite is he whose profession it is to live at the expense of his neighbor, and whose only employment consists in taking advantage of him, but prudently, so as not to endanger life. He is a pauper

who needs help, lest he should die on the public highway, but who practices the precept—not to kill the fowl in order to get the eggs. It is at once seen that he is essentially different from the messmate, who is simply a companion at table. The beast of prey kills its victim in order to feed upon his flesh, *the parasite does not kill*; on the contrary, he profits by all the advantages enjoyed by the host on whom he thrusts his presence."

The parasite fights only one struggle—that of survival and the maintenance of its own species. His mode of living greatly intensifies this struggle. In a continuous sequence, he must find new hosts. The entire existence of the parasites rests on the linkages which pass from host to host as the so-called "host or infection chains." A quick and regular destruction of the hosts would be most impractical and an extension of the chains would ultimately seal the fate of the parasite. Epidemics with a mortality of 80 to 90 per cent are rare and in every instance provisions are available to prevent the breaking of the chains in their many ramifications.

The methods which insure this continuity of transmission vary with the different infections. Some appear practical as, for example, in tularemia, Rocky Mountain spotted fever and plague, by which the transmission of the parasites is assumed by two or several different hosts. The localization in those

organs or tissues which provide for direct exits into the environment correspondingly aid the parasite in finding a new host. These pathways have a definite purpose. Should the portal of entry be identical with the site of localization and multiplication of the infective agent, the mode of escape or discharge is already established. Exit and terminus of the parasite rest in the same organ or tissue. Cholera, typhoid and dysentery are transmitted from "intestines to intestines," influenza and whooping cough from "lung to lung." A tendency on the part of the parasite to protect the host until it has fulfilled its function is indicated in a number of diseases. Whenever practicable, the physiologic functions of respiration, nutrition and procreation are exploited to the advantage of the disease agent. Yet notwithstanding these benefits, the paramount role, namely, the preservation of the parasite, is quite often left to factors of pure chance. A capricious action on the part of a host, a mere touch may establish the chain. Viewed from the standpoint of the biologist, one can not escape the conviction that the modes and methods chosen by nature are doubtless incomplete, even irrational. Despite these inadequacies, the parasites and consequently the microbial diseases continue to maintain themselves. Certain infections have existed for nearly 3000 years, but no disease of man or domestic animals has disappeared. Granted that the historic periods of observation are short but it must be remembered that during the same interval the dying out of free living animals and plants is not only documented by palaeontologic but by historical data. All the vicissitudes of inadequate and accidental transmission and the gigantic processes of destruction to which the parasites are exposed have been over-compensated, and as long as natural hosts in adequate number and proper intimacy maintain the infection chains, it is futile to anticipate a progressive extinction of the parasitic species.

The firmly entrenched position of certain epidemic maladies may at first appear unintelligible and mysterious. Measles attacks man once during his entire life span. The immunity conferred by this single infection lasts until death. In the language of the parasitologist, the disease has thus converted a suitable into an unsuitable host. Although measles is one of the oldest infections of mankind, its extensive epidemization and the continuous reduction of the hosts has merely converted it into a disease pre-eminently observed in early childhood. How can this contradiction be explained? The laws of genetics may offer an answer. From the evidence at hand it is obvious that the individually acquired loss of disposi-

tion is not an inheritable factor irrespective of the continuous renewal through hundreds of generations. On the other hand, the intact susceptibility as a species characteristic is transmitted from generation to generation.

Many years ago, it was shown by McCoy that the healthy rats or squirrels secured from cities or regions exposed for several years to plague infection are decidedly more resistant to artificial infection with *B. pustis* than those from localities in which the epidemic malady had not appeared among the rodents. The fatality rates among the animals vary inversely with the exposure of rats or squirrels to infection.

These observations and deductions received considerable support through the revival of the medically neglected field of constitutional pathology. Within recent years, noteworthy efforts have been made to prove that the infectious diseases act as selective factors, and that some of the susceptibilities perpetuate themselves as idiotypic characters in definite family groups. By direct selective breeding experiments, Lewis, Webster, Lambert, Schott, Irwin, Gowen and others have increased or lowered the resistance of mice, guinea pigs, rats, chickens, etc., to certain infections. Some of the differences have been insignificant while others have been of a relatively high order. Thus the susceptible strain of mice as developed by Webster showed a mortality of 85 to 95 per cent when infected with an enteritidis organism, while the resistant strain showed a mortality of the order of 15 per cent. On the other hand, the susceptible strain yielded a mortality of 40 per cent when tested against the virus of louping-ill, as compared with a 60 per cent in the resistant strain. The genetic factors, whatever they may be, do not seem to operate against all types of infections.

In 1900 the Swiss physician and naturalist, Naegeli, reported the interesting fact that the majority of human beings (97 per cent) living in Switzerland at that time were infected with the tubercle bacillus, but that a relatively small number suffered clinically from tuberculosis. Obviously, in the disposition to disease the morbid manifestations of the infection are individually variable and it is indeed reasonable to suspect in this and similar cases the influence of hereditary idiotypic factors. The study of monozygotic or identical twins by Diehl and v. Verschuer has given a truer explanation to the observation that there are families which are cursed by tuberculosis and to the former vague notion of constitutional disposition to this disease. In the course of these inquiries, both the clinical type and the environmental conditions were determined as far as possible. In a

total of 37 pairs of identical twins, both co-twins had developed tuberculosis in 26 pairs; only one of them in 11 pairs. Conversely, among 69 pairs of fraternal twins, concordancy with respect to tuberculosis was present in 17, discordancy in 52 cases. Among 7 pairs in which both members were affected in spite of no known exposure 5 pairs were identical and 2 fraternal. In some cases, the clinical type was strikingly similar. Of two identical twin brothers, within a time interval of 4 years both developed a surgical tuberculosis in the heel-bone. In the final analysis, the capriciousness in the occurrence of tuberculosis is a function of the differences in the genotypes acting under the influence of the environment; in this particular case the bacilli being facilitated by close aggregation in the family or home.

The constitutional influences are, however, by no means simple hereditary factors. From the evidence at hand, it appears that these are gene complexes which are neither transmitted nor maintained in pure lines. Genetic variability and peristatic forces more or less continuously obliterate the signs and sequelae of the constitutional evolution. There is, unfortunately, no theoretical foundation to support the expectation that families may in time purge themselves of those members who are highly susceptible to disease or that the selective survivals may transmit to their descendants the power to survive more readily the onslaught of infectious diseases. People or animals are more resistant to the attacks of the parasitic infections of their own countries and districts than to those of foreign territories with which they or their ancestors have been accustomed to come in contact. Certain diseases immediately following their introduction into a country previously exempt are particularly virulent but may in the course of centuries acquire a benign character. However, these well-known facts cannot be accepted as proofs for the selective elimination of constitutional susceptibility factors. With unremitting insistence, one must agree with Doerr that *the disposition or liability to disease and the disposition to infection are two totally separate entities*. The selective diminution in the disposition to disease is more than a hypothesis. A great many human beings are not manifestly diseased, but they are in a state of latent infection. Such maladies as diphtheria, typhoid fever, meningococcic meningitis, scarlet fever, infantile paralysis, sleeping sickness, etc. with variable host susceptibilities maintain themselves through carriers in which the parasite in a high percentage of human beings leads a commensal existence. An infectious disease without symptoms may be placed in evidence by direct or indirect laboratory methods, inoculation tests or serologic and

immunologic procedures. To the disappointment of every experimenter, latent bacterial or virus infections in laboratory animals have been made recognizable. With increasing frequency, "latent infections" are converted into visible diseases by transferring organ material of various animals to new hosts of the same or different species. In its broader aspects, the problem of "inapparent infections" permeates the problem of epidemics, since their natural fluctuations cannot be completely explained either through the frequency of the manifest infections or by the variability of the causative agents.

With increasing conviction it is being recognized that the tragedy of the events as well as the outcome of an infection are ultimately conditioned by the constitutional factors of man or animals and the *hereditary history* of the parasites. Both components of an infection are being subjected to genetic inquiries. Thus far, the contributions have been modest. Notwithstanding the foregoing tentative analysis a great many of the fundamental premises are missing. Relative to the mechanism of disposition to an infection, nothing definite is known. The susceptibility to disease is vaguely suspected but by no means understood; it is indeed impossible to separate the two conditions with any degree of certainty. However, it will be a momentous step in the right direction, when authoritative investigators abandon the one-sided concept that certain mysterious properties of the incitant, such as virulence, aggressiveness, etc., solely govern the entire problem of epidemics. In a recent analysis of an outbreak of rabbit-pox—a disease in many ways similar to human small-pox—and its analogy with the latter Greene concludes that forces affecting the human or rabbit population other than those concerned with the presence of an infecting organism and the specific immunity of the population were of greatest importance. The factors to be emphasized are first, environmental factors which affect the population as a whole and second, constitutional factors which render individuals more or less responsive to the action of environment.

(Continued in next issue)

VITAL STATISTICS USED IN TEACHING

The head of the science department of the Exeter Union High School has prepared statistical material covering typhoid fever, tuberculosis, infant mortality and other subjects in mimeographed form. Questions pertaining to the prevention and control of communicable diseases and the promotion of public health are appended. These mimeographed sheets are distributed to students for class use and provide an efficient device for teaching purposes.

MORBIDITY**Complete Reports for Following Diseases for Week Ending June 19, 1937****Chickenpox**

611 cases: Alameda 8, Berkeley 75, Oakland 17, Piedmont 2, San Leandro 1, Chico 1, Contra Costa County 1, El Cerrito 2, Richmond 1, Fresno County 7, Fresno 2, Kern County 3, Los Angeles County 48, Alhambra 5, Arcadia 1, Beverly Hills 2, Burbank 1, Covina 1, Compton 6, El Monte 5, Glendale 4, Huntington Park 7, Inglewood 14, Long Beach 10, Los Angeles 67, Monrovia 1, Pasadena 18, Redondo 1, Santa Monica 6, Sierra Madre 1, Whittier 3, Torrance 2, Monterey Park 3, Bell 1, Madera County 1, Marin County 9, Mill Valley 18, Monterey 12, Pacific Grove 1, Orange County 6, Anaheim 10, Fullerton 2, Newport Beach 1, Orange 7, Santa Ana 21, Placentia 1, Tustin 5, Corona 1, Riverside 2, Sacramento 20, San Bernardino County 4, San Bernardino 1, San Diego County 3, Chula Vista 2, National City 5, San Diego 27, San Francisco 58, Manteca 1, Stockton 1, San Luis Obispo County 2, San Luis Obispo 1, San Mateo County 1, Daly City 1, San Mateo 2, Santa Barbara County 12, Santa Barbara 1, Santa Clara County 1, Palo Alto 5, San Jose 2, Sunnyvale 1, Santa Cruz County 4, Rio Vista 25, Vallejo 1, Lindsay 1, Visalia 1, Ventura County 2, Fillmore 1, Woodland 1.

Diphtheria

38 cases: Alameda 1, Oakland 1, Fresno 1, Glenn County 1, Kern County 5, Los Angeles County 2, Los Angeles 9, Whittier 1, Orange County 1, Orange 1, Sacramento 2, San Diego 1, San Francisco 5, Ventura County 2, Ventura 1, Yolo County 4.

German Measles

30 cases: Alameda 1, Berkeley 4, San Leandro 1, Fresno County 1, Los Angeles County 4, Arcadia 1, Long Beach 2, Los Angeles 3, Pasadena 1, Torrance 1, Mono County 1, Napa 1, San Francisco 6, Stockton 3.

Influenza

147 cases: Kern County 11, Los Angeles County 2, El Monte 1, La Verne 1, Los Angeles 7, Santa Monica 1, Mill Valley 5, Lincoln 32, San Francisco 1, Rio Vista 67, Sonoma 16, Ventura County 2, Ventura 1.

Malaria

2 cases: Los Angeles County 1, Riverside County 1.

Measles

193 cases: Alameda County 1, Berkeley 1, Oakland 2, Piedmont 1, Contra Costa County 1, Fresno County 4, Fresno 1, Imperial County 1, Los Angeles County 4, Glendale 3, Huntington Park 1, Inglewood 3, Long Beach 4, Los Angeles 14, Redondo 1, Whittier 1, Torrance 1, Marin County 1, San Anselmo 1, Orange County 12, Anaheim 11, Newport Beach 3, Santa Ana 1, Placentia 1, Lincoln 18, Riverside County 1, Corona 23, Riverside 1, Sacramento 22, San Bernardino County 1, Colton 2, Ontario 1, San Diego County 16, El Cajon 6, La Mesa 1, National City 1, San Diego 8, San Francisco 16, Stockton 1, San Luis Obispo 1, San Mateo County 1, Ventura County 1, Yolo County 1, Woodland 2, Yuba County 1.

Mumps

477 cases: Alameda 3, Berkeley 30, Oakland 11, San Leandro 1, Gridley 1, Contra Costa County 2, El Cerrito 6, Richmond 4, Fresno County 4, Fresno 2, Reedley 1, Imperial County 1, Westmoreland 1, Bishop 12, Los Angeles County 27, Alhambra 3, Beverly Hills 1, Burbank 1, Covina 1, Compton 5, Glendale 2, Huntington Park 2, Long Beach 1, Los Angeles 27, Manhattan 5, Monrovia 3, Pasadena 1, Pomona 1, Santa Monica 8, South Gate 1, Monterey Park 1, Maywood 2, Bell 2, Madera 1, Marin County 6, Mill Valley 19, San Anselmo 7, Yosemite National Park 1, Monterey County 1, Orange County 4, Fullerton 16, Santa Ana 4, Lincoln 12, Riverside County 1, Riverside 6, Sacramento County 1, Sacramento 1, San Bernardino County 3, Colton 2, Redlands 1, San Diego County 5, Chula Vista 2, Coronado 1, National City 7, San Diego 49, San Francisco 108, Stockton 5, San Mateo County 1, Burlingame 1, Daly City 4, San Mateo 1, Santa Barbara County 6, Lompoc 2, Santa Barbara 7, San Jose 6, Tulare County 2, Ventura County 8, Santa Paula 1, Yolo County 2.

Pneumonia (Lobar)

38 cases: Amador County 1, Los Angeles County 3, Glendale 1, Inglewood 1, Long Beach 1, Los Angeles 13, San Gabriel 1, Santa Monica 1, Whittier 1, Monterey County 1, Monterey 2, Riverside County 1, Sacramento County 1, San Diego 2, San Francisco 5, Solano County 1, Sonoma 1, Woodland 1.

Scarlet Fever

151 cases: Emeryville 2, Oakland 9, Chico 3, Gridley 2, Martinez 3, Richmond 1, Fresno County 4, Fresno 2, Kern County 4, Lassen County 1, Susanville 1, Los Angeles County 13, Alhambra 1, Burbank 1, Compton 1, Glendale 2, Inglewood 1, Long Beach 1, Los Angeles 33, Pomona 2, Merced 1, Carmel 1, Monterey 2, Pacific Grove 1, Orange County 1, Anaheim 2, Fullerton 1, Newport Beach 1, Lincoln 2, Riverside County 2, Riverside 3, Sacramento 2, San Bernardino

County 1, Colton 2, San Diego 3, San Francisco 12, Stockton 2, Daly City 1, Santa Barbara County 1, Santa Barbara 1, Santa Clara County 1, San Jose 1, Santa Cruz County 4, Watsonville 1, Tehama County 3, Red Bluff 1, Tulare County 4, Lindsay 3, Ventura 2, Ojai 1, Yolo County 1.

Smallpox

21 cases: Berkeley 3, Pasadena 3, Pomona 2, Chula Vista 1, National City 3, San Diego 7, Ventura County 2.

Typhoid Fever

7 cases: Los Angeles 3, Sacramento County 1, Sacramento 1, California 2.*

Whooping Cough

466 cases: Alameda County 4, Alameda 1, Berkeley 12, Oakland 21, Butte County 3, Gridley 2, Calaveras County 1, Colusa County 1, Contra Costa County 6, Fresno County 2, Fresno 5, Kern County 10, Hanford 4, Los Angeles County 15, Alhambra 9, Burbank 2, Claremont 1, Culver City 3, El Monte 3, Glendale 1, Long Beach 3, Los Angeles 94, Montebello 1, Pasadena 16, Pomona 9, San Fernando 7, San Marino 2, Santa Monica 15, Torrance 4, South Gate 1, Signal Hill 1, Marin County 14, Mill Valley 2, St. Helena 1, Orange County 4, Santa Ana 6, Riverside County 8, Riverside 2, Sacramento 20, San Bernardino County 3, Colton 4, Redlands 3, San Bernardino 2, San Diego County 7, La Mesa 1, San Diego 9, San Francisco 48, Stockton 5, San Luis Obispo County 5, San Mateo County 6, Santa Barbara County 5, Santa Barbara 2, Santa Clara County 1, Mountain View 1, Palo Alto 3, Solano County 1, Rio Vista 14, Vallejo 2, Ventura County 13, Fillmore 1, Oxnard 2, Ventura 3, Yolo County 5, Woodland 4.

Meningitis (Epidemic)

2 cases: Los Angeles.

Dysentery (Amoebic)

4 cases: Los Angeles 1, King City 1, San Bernardino County 1, Ventura County 1.

Dysentery (Bacillary)

7 cases: Los Angeles 2, Santa Monica 3, Madera County 1, Rio Vista 1.

Pellagra

4 cases: Oakland 1, Los Angeles 3.

Poliomyelitis

7 cases: Kern County 3, Napa 1, National City 1, San Diego 1, Tulare County 1.

Tetanus

2 cases: Oakland 1, Glendale 1.

Trachoma

4 cases: Riverside County 3, San Francisco 1.

Encephalitis (Epidemic)

2 cases: San Francisco 1, San Joaquin County 1.

Paratyphoid Fever

One case: South Pasadena.

Food Poisoning

10 cases: San Francisco.

Undulant Fever

5 cases: Los Angeles 1, Riverside County 1, San Bernardino County 2, Stockton 1.

Actinomycosis

One case: Los Angeles.

Rabies (Animal)

53 cases: Coalinga 1, Los Angeles County 9, Culver City 1, Long Beach 2, Los Angeles 28, San Fernando 1, Santa Monica 2, Torrance 1, Lynwood 1, Los Banos 1, Sacramento 1, San Bernardino County 1, Colton 1, San Joaquin County 1, Stanislaus County 1, Modesto 1.

* Cases charged to "California" represent patients ill before entering the state or those who contracted their illness traveling about the state throughout the incubation period of the disease. These cases are not chargeable to any one locality.

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